NOTE V.

DESCRIPTIONS OF EARTHWORMS

BY

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IX.

ON TWO NEW BENHAMIA-SPECIES FROM LIBERIA.

(Plate 1).

Benhamia liberiensis n. sp.

Last year the Leyden Museum received from Liberia some large *Benhamia*-specimens, agreeing in size with *Benhamia Büttikoferi* [1]) from the same country; however after a careful examination they turned out to belong to a new species.

The largest specimen measures 350 mm. in length; its average diameter is about 10 mm., and it tapers only slightly within a few segments of the posterior end. There are about 250 segments, each divided by a ridge into two annuli; the setae are situated upon this ridge. The coloration of the worm is of a dark violet-brown, but the clitellum and the ventral side of the segments in front of it have a yellowish hue.

The clitellum extends over segments (XIII) XIV—XX; it is complete except on an oblong, rectangular, ventral area in the middle of segments XVII—XIX. The openings of the prostata-glands and the male pores, situated

1) Notes Leyden Museum, vol. IX, 1887, p. 291, pl. 5.

within this depressed field, are connected by a brace-shaped groove, at the concave side of which lie two papillae (fig. 1); moreover another pair of papillae is to be found in the anterior and the posterior part of the area. These four pairs of papillae are even visible in badly preserved specimens, where the ventral area is hardly recognizable. In front of the clitellum three unpaired, transverse copulatory papillae occur in the ventral mesial line; they lie in the intersegmental grooves X/XI, XI/XII and XII/XIII, but are rather indistinct in some specimens. Dorsal pores present, but hardly visible.

Two pairs of spermathecal pores are situated in the intersegmental grooves VII/VIII and VIII/IX; the pores of each pair lie next to each other, upon a white area, in a position which corresponds to the interval between the ventral pairs of setae.

The setae are situated ventrally, visible behind the clitellum as four white spots; the interval between both ventral couples nearly equal to that between the ventral and dorsal ones. In front of the clitellum the ventral interval is smaller than the lateral one.

The penial setae, a fascicle of which arises next to each prostata-gland, present an appearance, quite different from that of the ordinary setae; they are of a golden yellow colour, except at the distal end. Each seta (fig. 2) is faintly bent, has a length of 3 mm., and is of about the same diameter over its whole length, except at the distal extremity, which is dilated like a spatula. The distal half of the seta is beset with small, densely crowded spines (fig. 2*a*).

Besides the penial setae our species possesses another kind of modified setae, which are situated in front of the anterior spermatheca and replace the ventral setae of segment VII; these copulatory setae are connected with the body-wall by a strong muscle-fascicle, and are accompanied by a glandular body, that has a pyriform shape and presents longitudinal grooves (fig. 4). Each copulatory seta is faintly curved like a penial seta, but is not so slender; its length is $2^1/_2$ mm.

and it has about the same diameter over its whole length. Its distal extremity (fig. 3) shows a conical point and beneath this the seta is beset with circles of spines, over a third of its length.

The glandular body consists of two lobes, lying next to each other, but each of them is provided with a central canal, that opens next to a copulatory seta. The gland consists of club-shaped cells, resembling those of the prostata, which discharge their secretion into the central canal. In *Benh. Beddardi* [1]), described by myself some years ago, the copulatory setae in the neighbourhood of the spermathecae are also joined by a glandular body, which however is much larger and consists of several lobes; its internal structure fully agrees with that of *B. liberiensis*, for each lobe possesses a central canal, which opens into the sheath of the copulatory setae.

There are two pairs of spermathecae, differing in shape from those of the smaller *Benhamia*-species; each of them (fig. 4) has a somewhat mushroom-like feature, and consists of a rounded vesicle, with irregularly folded surface and a short excretory duct. This duct shows at its anterior and posterior side an enlargement, upon which several wart-shaped excrescences are visible. Transverse sections of the duct (fig. 5) prove that those warts enclose small coeca, filled with spermatozoa; the lumen of the duct is strongly folded and gives rise to several tubular diverticles, which are dilated at their distal end and those vesicles contain the spermatozoa. It struck my attention, that the low epithelial cells, which as usually line those coeca, not only present very indistinct boundaries, but are nearly totally absent in some places, especially where the balls of spermatozoa are lying against the wall of the coeca. It seems to me very likely, that this epithelium presents a stade of degeneration, and this fact seems to favour the assertion of Beddard, made about the sper-

1) loc. cit. vol. X, 1888, p. 123, pl. 6.

mathecae of *Acanthodrilus*, »that the spermatozoa become embedded in granular masses, which are formed by the metamorphosis of the lining epithelium of the spermathecal diverticula" [1]). In the main pouch itself no spermatozoa were met with, only a granular coagulum was to be found. In *Dichogaster Damonis* [2]) the spermathecae have also a mulberry-like diverticulum, consisting of numerous small coeca, enclosed within a common muscular sheath. Likewise *Argilophilus* [3]) has the sperma stored in numerous chambers, embedded in the muscular layer of the duct; however Eisen does not describe nor figure any epithelium in these chambers. I cannot believe that it should be entirely wanting, perhaps the layer has been lost here, or has become so thin, that it was overlooked. The spermatheca of the allied *Benh. Beddardi,* is not only distinguished by its having the sperma contained in a couple of small diverticula at the sides of the duct, next to the external orifice, but is especially characterized by the structure of the wall of its excretory duct (fig. 6). This wall, as stated before, contains a great number of glandular tubes, which lie parallel to the longitudinal axis of the duct and enter its lumen in the vicinity of the spermathecal pore; whether some of these tubes communicate with each other, could not be recognized. The tubes are surrounded by a network of bloodvessels and two kinds of cells occur in their lining epithelium. In the superior region of each tube the epithelial layer consists of cylindrical cells with finely granular protoplasma, but the inferior part presents numerous pyriform cells, showing clear contents.

As regards the rest of the internal anatomy, this worm agrees with the other *Benhamia*-species. The prostata is a long, tubular gland, irregularly bent. The nephridia

1) Quart. Journal of Microsc. Science, vol. XXX, p. 466.

2) ibidem, vol. XXIX, p. 257, pl. XXIV, fig. 20.

3) California Eudrilidae; Memoirs California Acad. of Sciences, vol. II, 1894, p. 50, pl. XX, figs. 81—85.

are diffuse, especially developed in the clitellar region. The septa XI, XII and XIII are very thick and muscular.

The intestinal canal presents two gizzards in segments VII and VIII, and three pairs of reniform coeca in segments XV, XVI and XVII. The first of them, as usually the smallest, has a plain wall, but the two larger ones show shallow, horizontal grooves. The observation of Beddard with regard to *Microdrilus saliens* [1]), that the three pouches of each side do not open separately into the gut, but communicate with the intestinal canal by one common duct, induced me to examine this structure in the present species. I was not little astonished to find about the same arrangement; each gland does not enter the intestine separately, but there is only a single duct, situated in the XVIth segment, which seems to belong to the foremost pouch, and the second and third coeca are connected with it by short tubes. I suppose that other *Benhamia*-species will show the same arrangement and I cannot therefore agree with Michaelsen's suggestion, that the two posterior coeca should have another function as the anterior one, because he usually found no carbonate of lime in them [2]).

This species without doubt is nearly allied to *B. Beddardi*, which differs however by having *two* pairs of fascicles of copulatory setae unlike the penial setae. This character seems also to occur in the genus *Dichogaster*, for Michaelsen states about *Dichogaster Hupferi* [3]), that to the spermathecae there are appended fascicles of copulatory setae, differing from the penial bristles; however the author makes no mention of a glandular apparatus.

1) Proc. Zoologic. Society, 1892, p. 683, pl. XLVI, fig. 8.

2) Deutsch-Ost-Afrika; Regenwürmer, 1895, p. 26.

3) Jahrb. Hamburg. Wissensch. Anst. vol. IX, 1891, p. 66, pl. IV, figs. 31 and 32.

Benhamia Stampflii[1]) n. sp.

Among the *Benhamidae* from Liberia I met with a specimen, that not only differs in its external appearance from the preceding species, but also shows internal characters, for which it seems to me to belong to an other species.

It belongs to the larger *Benhamia*-species, its length being about 330 mm. The average diameter of the body is about 10 mm., and it tapers only near the caudal end. The number of the segments is no less than 425, so their longitudinal diameter is much smaller than in *Benh. liberiensis*. The colour of the worm is pale violet-brown at the dorsal, yellowish gray at the ventral side.

The intersegmental grooves and the dorsal pores behind the clitellum are very obvious. The cephalic lobe extends backward with a narrow part over the half of the buccal segment. The setae are ventrally; the interval between the ventral pairs is a little smaller than that between a ventral and a dorsal pair. The spermathecal pores are situated in the intersegmental grooves VII/VIII and VIII/IX, in a common groove, next to each other. The clitellum is distinct, wrinkled, occupying segments XIII—XXI. At the ventral side of segments XVI—XXI there is an area, having the shape of a reversed lyre; it is depressed in its anterior half, but appears not glandular in its posterior half.

There are two pairs of spermathecae, consisting of a globular sac, with a short excretory duct, bulged out at one side; I suggest that the spermatozoa are stored in this protuberance.

Each fascicle of penial setae contains two or three of them; they are about 3 mm. long, transparent, plain, without any ornament. Each seta has about the same diameter over its whole length, but suddenly becomes thinner near

1) Named after Mr. Stampfli, the companion of Mr. Büttikofer in his exploration of Liberia.

its distal end, which is somewhat enlarged; highly magnified this enlarged extremity proves to have the shape of a concave chisel, resembling some Eunice-bristles.

The rest of its internal structure does not present any special points of interest and agrees mainly with that of *Benh. Schlegelii* [1]). The intestinal coeca are rather large and show numerous foldings; each of them is separately connected with the intestinal canal.

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EXPLANATION

OF

Plate 1.

Fig. 1. *Benhamia liberiensis* Horst. Ventral view of the anterior region of the worm, to illustrate the feature of the clitellar area. × 2 diam. *sp. p.* spermathecal pores; ♂ male pore.

Fig. 2. A penial seta. × 36 diam.; 2 *a* distal extremity of the same, highly magnified.

Fig. 3. Distal end of a copulatory seta. × 90 diam.

Fig. 4. A spermatheca, with the fascicle of copulatory setae and the glandular body. × 7 diam.

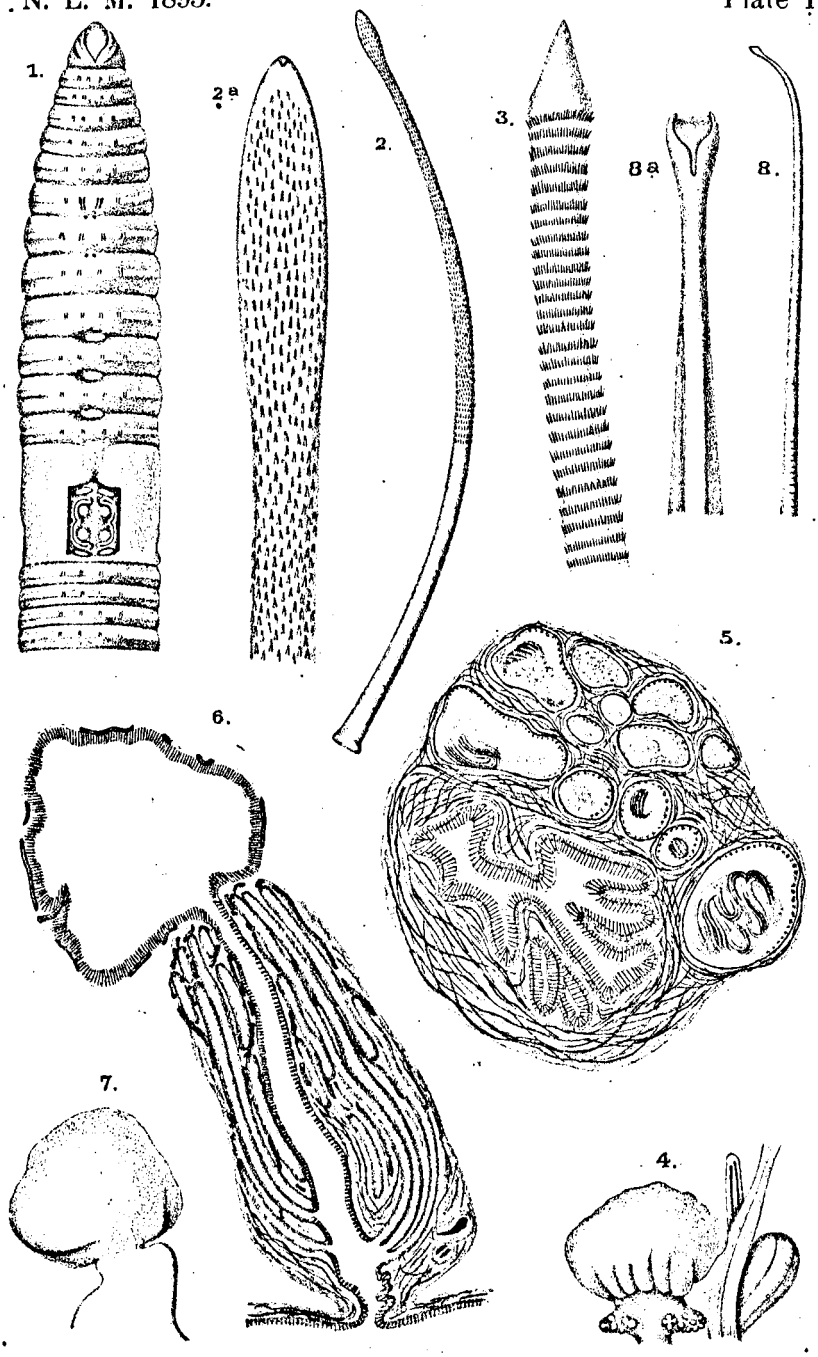
Fig. 5. A transverse section through the excretory duct of a spermatheca, to show the diverticula of the duct, filled with spermatozoa. × 65 diam.

Fig. 6. *Benhamia Beddardi* Horst. A longitudinal section through the spermatheca, to show the glandular tubes of the excretory duct and the vesicles, containing the spermatozoa.

Fig. 7. *Benhamia Stampflii* Horst. A spermatheca. × 15 diam.

Fig. 8. A penial seta. × 20 diam.; 8 *a* the distal end of the same, highly magnified.

1) Notes Leyden Museum, vol. IX, 1887, p. 252, pl. 4.



Dr. R. Horst ad nat. del. A. J. J. Wendel lith. P. W. M. Trap impr.

1—5. Benhamia liberiensis *Horst.* 6. Benhamia Beddardi *Horst.*
7—8. Benhamia Stampflii *Horst.*